# CHAPTER 8

# PHARMACY

With advancement comes greater responsibilities and more specialized assignments. As you progress to Hospital Corpsman Third Class and eventually to Second Class, you will be assigned duties in specialized departments throughout the hospital and especially aboard ship. Not only will your responsibilities increase, but your training will become more and more diversified.

One of the departments to which you may be assigned is the pharmacy, where you will assist in compounding, preparing, and dispensing medicines. This chapter will give you a basic introduction to the field of pharmacy and prepare you for the requirements of your next rate.

## PHARMACY

Pharmacy may be defined as the art and science of identifying, collecting, standardizing, compounding, and dispensing medicinal substances of various kinds and combinations used in preventive and curative medicine.

Pharmacy is symbolized by the superscription Rx, now generally understood to represent a contraction of the Latin imperative recipio, meaning "take thou."

## PUBLICATIONS OF PHARMACY

There are several books that contain standardized reference material used throughout the profession. You should become familiar with them and at the earliest opportunity browse through a copy to get an idea of their contents.

There is one book with official (legal) status that is a constant source of reference for pharmacists: the *United States Pharmacopoeia and National Formulary* (USP-NF). It is endowed with legal status by the U.S. Government and its contents have been upheld in courts of law, up to and including the U.S. Supreme Court.

It provides regulatory agencies with enforceable standards of purity, quality, and strength for drugs generally accepted by the medical profession. Manufacturers or pharmacists who label their product as "USP" must conform to the standards of preparation set forth therein.

The USP-NF is revised every 5 years. The drugs and preparations listed and described in the current USP-NF are only those that have stood the test of research and continued use, leaving absolutely no doubt as to their efficacy and acceptance by the medical professions.

The *Physicians' Desk Reference is* an annual publication intended primarily for physicians and is referred to as the PDR. It is usually found in the pharmacy, on wards, and in clinics of medical treatment facilities. It provides essential prescription information on major pharmaceutical products as prepared by manufacturers in consultation with the publisher. It contains five color-coded sections that aid in finding drug information and contains a product identification section that shows drug products in actual size and color.

*Remington's Pharmaceutical Sciences* is an excellent source book for compounding information. It is a basic text of pharmaceutical science that is known as the Pharmacist's Bible.

## METROLOGY AND CALCULATION

Metrology, called the arithmetic of pharmacy, is the science of weights and measures and its application to drugs and their dosage, preparation, compounding, and dispensing.

It is absolutely vital for hospital corpsmen to thoroughly understand the principles and applications of metrology in pharmacy. Without a thorough knowledge of this field, one cannot function adequately in compounding and dispensing drugs. Errors in this area endanger the health, even life of the patient, and lead to embarrassment and tragedy.

### THE METRIC SYSTEM

This is the official system of weights and measures used in the Navy and is rapidly becoming the universally accepted system through the modern world. As hospital corpsmen, we will concern ourselves primarily with the divisions of weight, volume, and linear measurement of the metric system. Each of these divisions has a primary or basic unit.

**Table 8-1.—Measuring equivalents**

| Systems of Weights | Systems of Volume Measures | Linear Measure |
|---|---|---|
| **AVOIRDUPOIS** | | |
| Primary unit of weight is the grain. | | |
| 437.5 grains = 1 ounce (av. oz.) | | |
| 16.0 ounces = 1 pound (av. lb.) | | |
| **APOTHECARY** | **APOTHECARY** | |
| Primary unit of weight is the grain. | Smallest unit of volume is the minim. | |
| 20 grains (gr) = 1 scruple (℈) | 60 minims (m) = 1 fluid dram (ʒ) | |
| 3 scruples = 1 dram (ʒ) | 8 fluid drams = 1 fluid ounce (℥) | |
| 8 drams (480 gr) = 1 ounce (℥) | 16 fluid ounces = 1 pint (0) | |
| 12 ounces = 1 pound (lb) | 2 pints = 1 quart (qt.) | |
| | 4 quarts = 1 gallon (Cong. or gal.) | |
| **METRIC** | **METRIC** | **METRIC** |
| Primary unit of weight is the gram. | Primary unit of volume is the liter. | Primary unit of linear measure is the meter. |
| 1000.000 grams = 1 kilogram (kg) | 1000.000 liters = 1 kiloliter (kl) | 1000.000 meters = 1 kilometer (km) |
| 100.000 grams = 1 hectogram (hg) | 100.000 liters = 1 hectoliter (hl) | 100.000 meters = 1 hectometer (hm) |
| 10.000 grams = 1 dekagram (dkg) | 10.000 liters = 1 dekaliter (dkl) | 10.000 meters = 1 dekameter (dkm) |
| 1.000 gram = 1 gram (gm) | 1.000 liter = 1 liter (l) | 1.000 meter = 1 meter (m) |
| 0.1 gram = 1 decigram (dg) | 0.1 liter = 1 deciliter (dl) | 0.1 meter = 1 decimeter (dm) |
| 0.01 gram = 1 centigram (cg) | 0.01 liter = 1 centiliter (cl) | 0.01 meter = 1 centimeter (cm) |
| 0.001 gram = 1 milligram (mg) | 0.001 liter = 1 milliliter (ml) | 0.001 meter = 1 millimeter (mm) |

NOTE: The relationship of the basic units in the Metric System should be noted. The meter, which is 1/40,000,000 of the earth's polar circumference, is the natural standard. The volume contained in 1/10 of a meter cubed is 1 liter. The weight of 1 cubic centimeter of distilled water is 1 gram. Grams of water are approximately equivalent at all temperature ranges. Current usage prefers that ml rather than cc be used since it has been found that 1000 cc do not equal exactly 1 liter.

The basic unit of weight in the metric system is the gram. NOTE: The abbreviation for gram is "g."

The basic unit of volume in the metric system is the liter, abbreviated "1."

The basic linear unit of the metric system is the meter, abbreviated "m."

By using the prefixes deka, hecto, and kilo for multiples often, one hundred, and one thousand basic units, and the prefixes micro, mini, centi, and deci for one ten thousandth, one thousandth, one hundredth, and one tenth, you have the basic structure of the metric system. By applying the appropriate basic unit to the scale of figure 8-1, you can readily determine its proper terms. For instance, using the gram as the basic unit of weight, we can readily see that 10 g would be 1 dekagram, 100 g would equal 1 hectogram, and 1000 g are called a kilogram. Conversely, going down the scale, 0.1 g is then called a decigram, 0.01 g a centigram, and 0.001 g is called a milligram. NOTE: In the metric system, no units or their abbreviations are capitalized.

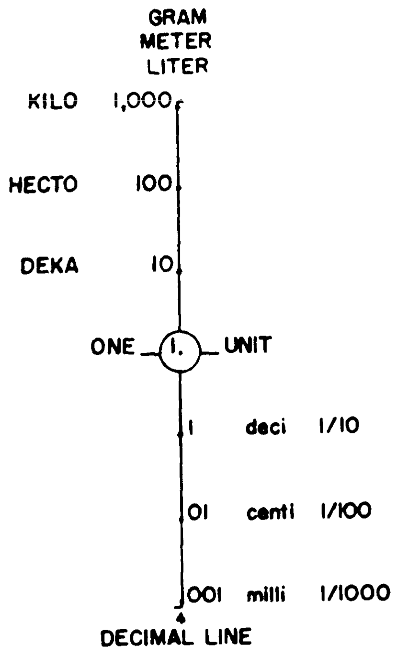



Figure 8-1.—Metric system.

## THE APOTHECARY SYSTEM

Although fast becoming obsolete, the apothecary system is still used and must be taken into consideration. It has two divisions of measurement: weight and volume. The basic unit of weight is the grain, abbreviated gr, and never capitalized; and the basic unit of volume is the minim.

## THE AVOIRDUPOIS SYSTEM

This system is the one used in the United States for weight only and is used in commercial buying and selling. The pound as we know it when going to the market is the 16-ounce pound of the avoirdupois system. The basic unit of the avoirdupois system is also the grain.

## TABLE OF WEIGHTS AND MEASURES

Table 8-1 is a table of weights and measures; it should be thoroughly studied and memorized.

## CONVERTING WEIGHTS AND MEASURES

Occasionally there are times when it will be necessary to convert weights and measures from one system to another, either metric to apothecary or vice versa. Since patients can hardly be expected to be familiar with either system, always translate the dosage directions on the prescription into a household equivalent that they understand. Therefore, the household measurements are standardized, assuming that the utensils are common enough to be found in any home. Table 8-2 is a table of household measures, with their metric and apothecary equivalents.

**Table 8-2.—Table of metric doses with approximate equivalents**

**CAUTION:** For the conversion of specific quantities in a prescription or in converting a pharmaceutical formula from one system to another, exact equivalents must be used.

| Metric | Apothecary | Household |
|---|---|---|
| 5 ml | 1 fl dr | 1 teaspoonful* |
| 10 ml | 2 fl dr | 1 dessertspoonful |
| 15 ml | 4 fl dr | 1 tablespoonful (1/2 fl oz) |
| 30 ml | 8 fl dr | 2 tablespoonfuls (1 fl oz) |
| 60 ml | 2 fl oz | 1 wineglassful |
| 120 ml | 4 fl oz | 1 teacupful |
| 240 ml | 8 fl oz | 1 tumblerful |
| 480 ml | 16 fl oz | 1 pint |
| 960 ml | 32 fl oz | 1 quart |

*Official U.S.P. teaspoonful is 5 ml.

## CONVERSION

It is often necessary in the practice of pharmacy to convert from one system to another in order to dispense the substances that have been ordered in their proper amounts. Although the denominations of the metric system are not commensurate with those of the common systems, the Bureau of International Standards has established conversion standards that will satisfy the degree of accuracy required in almost any practical situation. Ordinary pharmaceutical procedures generally require something between two- and three-figure accuracy, and the following tables of conversion are more than sufficient for practical use. Naturally, if potent agents are involved, you must use a more precise conversion factor for purposes of calculation.

### Conversion Table for Weights and Liquid Measures

1 grain = 0.065 gram or 65 milligrams
1 gram = 15.432 grains
1 milliliter = 16.23 minims
1 fluid ounce = 29.57 milliliters

To convert from:

| | |
|---|---|
| 1. gr to g | gr/15.432 = g |
| 2. ml to fl oz | ml/29.57 = fl oz |
| 3. minims to ml | minims/16.23 = ml |
| 4. mg to gr | mg/65 = gr |
| 5. g to gr | g × 15.432 = gr |
| 6. fl oz to ml | fl oz × 29.57 = ml |
| 7. ml to minims | ml × 16.23 = minims |
| 8. gr to mg | gr × 65 = mg |

## REDUCING AND ENLARGING FORMULAS AND DOSES

### REDUCING FORMULAS

In compounding, you will often find it necessary to reduce or enlarge the original recipe or formula. Most of the formulas in the USP-NF are given in quantities of 100 g or 1000 g of weight or milliliters of volume total.

There are many ways of reducing and enlarging formulas. The methods most commonly used are:

1. Ratio and proportion.

Example: Reduce the following formula for potassium arsenite solution to make 120 ml.

Arsenic trioxide . . . . . . . . . . . . . . . . . . . . 10g

Potassium bicarbonate . . . . . . . . . . . . . . .7.6 g

Alcohol . . . . . . . . . . . . . . . . . . . . . . . . . . . .30ml

Distilled water, a sufficient
quantity to make, . . . . . . . . . . . . . . . 1000ml

By using ratio and proportion, the amount of arsenic trioxide to be used:

1000 : 120 :: 10 : X
1000 X = 1200
X = 1.2 g of arsenic trioxide needed.

For potassium bicarbonate:

000 : 120 :: 7.6 : X
1000 X = 912
X = 0.912 g of potassium bicarbonate needed.

For alcohol:

1000 : 120 :: 30 : X
1000 X = 3600
X = 3.6 ml of alcohol needed.

The new formula is written as follows:

Arsenic trioxide . . . . . . . . . . . . . . . . . . . .1.2 g

Potassium bicarbonate . . . . . . . . . . . . . 0.912 g

Alcohol . . . . . . . . . . . . . . . . . . . . . . . . . . .3.6 ml

Distilled water, q.s. . . . . . . . . . . . . . . . . .120.0 ml

2. Fractional method.

The numerator will be the amount of the new formula, and the denominator will be the amount of the original formula. Example: Reduce the formula for the potassium arsenite solution in the preceding item to make 120 ml.

For arsenic trioxide:

120/1000 × 10 = 1.2 g

potassium bicarbonate:

120/1000 × 7.6 = 0.912 g

alcohol:

120/1000 × 30 = 3.6 ml

water:

q.s. to 120 ml

## ENLARGING FORMULAS

Use the fractional method as above.

Example: Calculate the amounts of ingredients for a gallon of the following liquid:

Glycerin . . . . . . . . . . . . . . . . . . . . . . . . . . .3 fl dr

Liq. phenol . . . . . . . . . . . . . . . . . . . . . . . . .1fldr

Water q.s . . . . . . . . . . . . . . . . . . . . . . . . . .4 fl dr

There are 128 fl oz in a gallon. The fraction would then become 128/4 or 32. Multiply each ingredient by 32.

3 fl dr x 32= 96 fl dr or 12 fl oz of glycerin.
1 fl dr x 32 = 32 fl dr or 4 fl oz of liq phenol.

Then add sufficient quantity of water to make the total volume measure 128 fl oz (one gallon).

## REDUCING DOSES

Use ratio and proportion.

Example: We have 1/2 gr tablets on hand, and we want to give the patient a 1/8 gr dose. Use 24 minims of water as the solvent.

1/2gr . . . . . . . . . . . . . . . . ..24 minims of solvent

1/8gr . . . . . . . . . . . . . . . . .. X minims of solution

1/2: 1/8::24:X
1/2 X = 3
X = 6

Give the patient 6 minims of the solution.

## ENLARGING DOSES

Use ratio and proportion.

Example: A tablet contains 1/2 gr of phenobarbital, and we wish to give the patient 3/4 gr.

Dissolve 2 tablets in 4 ml of water:

1 gr . . . . . . . . . . . . . . . . . . . . . .4 ml of solvent

3/4 gr . . . . . . . . . . . . . . . . . . . . X ml of solution

1: 3/4 :: 4 : X
X = 3

Give the patient 3 ml of the solution.

## MATHEMATICS

A review of basic mathematics will help you understand the important phases of pharmaceutical calculations.

## DECIMALS

The decimal point represents a power of 10. Every time the decimal is moved one digit to the right, the number is multiplied by 10 and conversely, every time it is moved one digit to the left, the number is divided by 10.

Example:

3.0—if we move the decimal one digit to the right: 30.0, we have multiplied the number 3 x 10 = 30. If we move it another digit to the right, we have again multiplied by 10: 30.0 x 10 = 300.0.

3. 0—moving the decimal one digit to the left, we will have divided the number 3 by 10: 3 ÷ 10 = 0.3.

If we move the decimal another digit to the left, we will have divided by 10 again: 0.3 ÷ 10 = 0.03, and so forth.

The number, or numbers, left of a decimal point are whole numbers or units; the numbers to the right of the decimal point are fractional parts of the same unit. If you compare the decimal with our monetary system, this is readily understood.

| | | | | |
|---|---|---|---|---|
| Example: 3.85 | 3 gram | 3.85 | 3 dollars |
| grams = | 8 decigrams | dollars = | 8 dimes |
| | 5 centigrams | | 5 cents |

### Addition of Decimals

When adding, keep the decimal points in a vertical line to avoid confusing fractional numbers with whole numbers.

Examples:

| | |
|---|---|
| 1.30 | .065 |
| .50 | 1.435 |
| 11.2 | 23.015 |
| .015 | 456.65 |
| 13.015 | 481.165 |

### Subtraction of Decimals

Keep the decimal points in a vertical line.

Examples:

$$\begin{array}{r} 30.5 \\ -15.432 \\ \hline 15.068 \end{array} \qquad \begin{array}{r} 16.23 \\ -4.29 \\ \hline 11.94 \end{array}$$

### Multiplication of Decimals

The number of places to point off from the right in the product is found by adding the number of places in the multiplicand and the multiplier.

Example:

$$\begin{array}{r} 2.5 \\ \times\ 5 \\ \hline 12.5 \end{array} \text{ 1 place } \quad \begin{array}{r} 5.5 \\ \times\ 2.2 \\ \hline 110 \\ 110\ \\ \hline 12.10 \end{array} \text{ 2 places } \quad \begin{array}{r} 5.11 \\ \times\ \ 2.5 \\ \hline 2555 \\ 1022\ \\ \hline 12.775 \end{array} \text{ 3 places}$$

### Division of Decimals

Division means to determine how many divisors are equivalent to the dividend.

DIVIDEND ÷ DIVISOR = QUOTIENT

or,

$$\text{DIVISOR} \overset{\text{QUOTIENT}}{\overline{\smash{)}\text{DIVIDEND}}}$$

Make the divisor a whole number by moving the decimal point to the right of the last figure.

Move the decimal point in the dividend as many digits to the right as it was move in the divisor.

Place the decimal point in the quotient (answer) directly above the new position of the decimal in the dividend.

Example: Divide 510 by 25.5

1st step, $25.5 \overline{\smash{)}\ 510.}$

2nd Step, $255. \overline{\smash{)}\ 5100.}$

3rd Step $\begin{array}{r} 20 \\ 255. \overline{\smash{)}\ 5100.} \\ 510\ \\ \hline 0 \end{array}$

Therefore $510 = 20 \times 25.5$

### Helpful Hints When Multiplying or Dividing by Decimals

To multiply by 10, move the decimal point one place to the right. To multiply by 100, move the decimal point two places to the right. In other words, move the decimal point to the right to coincide with' the number of zeroes in the multiplier when it is stated in the "10s."

Division by powers of 10 require moving the decimal point to the left by one place for each zero that appears in the divisor.

### Changing a Decimal to a Common Fraction

Write the denominator in the power of 10 and reduce to lowest terms.

Examples: 0.8 would be 8/10 reduced to 4/5
0.04 would be 4/100 reduced to 1/25

## FRACTIONS

A fraction is an expressed PART of a unit. The parts of a fraction are the:

NUMERATOR—the first or upper part of a fraction that indicated the number of the equal parts of a unit concerned.

DENOMINATOR—indicates the number of parts into which a unit is divided and constitutes the second or lower part of a fraction.

### Types of Fractions

Proper fraction—a fraction whose numerator is less than the denominator.

Examples: 1/2, 6/11, 22/75, 41/111

Improper fraction—a fraction whose numerator is equal to or greater than the denominator.

Examples: 3/3, 15/10, 45/30, 101/9

Mixed numbers—a whole number combined with a fraction.

Examples: 1 1/2, 2 3/5, 55 7/10

### To Change a Mixed Number to an Improper Fraction

Multiply the whole number by the denominator of the fraction and add the numerator to this product; write this sum over the denominator.

Example: 5 6/7 (7 × 5 = 35) + 6 = 41/7

### Addition of Fractions

In order to add fractions, you must determine a common denominator (a number that is evenly divisible by each of the denominators concerned).

Example 1/2 + 1/3 + 5/6 = ?

1. Multiply the denominators by each other. This gives you a common denominator.

   2 × 3 × 6 = 36

2. Divide each original denominator into this common denominator and multiply the quotient by the old denominator. This gives you new numerators.

   18/36 + 12/36 + 30/36

3. Reduce each fraction to lowest terms.

   18/36 + 12/36 + 30/36 = 3/6 + 5/6

4. Add the numerators only, place the sum over the common denominator, and reduce to lowest terms.

   3/6 + 2/6 + 5/6 = 10/6 = 1 4/6 =

Therefore 1/2 + 1/3 + 5/6 = 1 2/3

### Subtraction of Fractions

1. Establish a common denominator.
2. Subtract one numerator from the other.
3. Reduce to lowest terms.

Example:

9/11 - 3/4 = 36/44 - 33/44 = (36 - 33)/44 = 3/44

### Multiplication of Fractions

1. Multiply the numerators to determine the new numerator.
2. Multiply the denominators to determine a new denominator.
3. Write the new numerator over the new denominator and reduce to lowest terms.

Examples: a. 1/2 × 1/2 = 1/4
b. 2/3 × 3/5 = 6/15 = 2/5

NOTE: If you have a mixed number to multiply, change to an improper fraction and proceed as above.

Example: 2 1/2 × 1 1/4 = 5/2 × 5/4 = 25/8 = 3 1/8

### Division of Fractions

1. Invert the divisor.
2. Change the division sign to a multiplication sign and proceed as in multiplication.
3. Reduce to lowest terms.

Example: 1/4 ÷ 3/4 = 1/4 × 4/3 = 4/12 = 1/3

NOTE: If mixed numbers are involved, change to improper fractions and proceed as above.

Example: 1 3/8 ÷ 2/5 = 11/8 ÷ 2/5 = 11/8 × 5/2 = 55/16 = 3 7/16

### To Change a Fraction to a Decimal

Divide the numerator by the denominator. Some of the results can be stated in their exact equivalents such as 1/2, 1/4, or 2/5; others will not divide evenly and will be expressed as close approximates.

Examples: 1/4

$$
\begin{array}{r}
.25 \\
4\,\overline{)1.00} \\
\underline{8\phantom{0}} \\
20 \\
\underline{20}
\end{array}
$$

1/7

$$
\begin{array}{r}
.14 \\
7\,\overline{)1.00} \\
\underline{7\phantom{0}} \\
30 \\
\underline{28}
\end{array}
$$

## PERCENTAGE

Percentage means "parts per hundred" or the expression of fractions with denominators of 100. Thus a 10 percent solution may be expressed as 10%, 10/100. 0.10, or 10 parts per 100 parts.

It is often necessary for the pharmacist to compound solutions of a desired percentage strength.

Percentage in that respect means parts of active ingredient per 100 parts of total preparation.

The three basic rules to remember in solving percentage problems are:

1. To find the amount of the active ingredient when the percentage strength and the total quantity ARE known, multiply the total weight or volume by the percent (expressed as a decimal fraction).

Example: Substance X contains 38% fat. How many grams of fat are required to prepare 120 g of substance X?

Solution: 38% is expressed as a decimal fraction 0.38 and multiplied by the amount of the finished product required.

$$\begin{array}{r} 120\ \text{g} \\ \times .38 \\ \hline 960 \\ 360\phantom{0} \\ \hline 45.60 \end{array}$$

45.60 g—the weight of fat needed.

2. To find the total quantity of a mixture when the percentage strength and the amount of the active ingredient are known, divide the weight or volume of the active ingredient by the percent (expressed as a decimal fraction).

Example: If a mixture contains 20% of substance Y, how many grams of the 20% mixture would contain 8 g of Y?

Solution: 20% is expressed as a decimal fraction 0.20. Divide the weight (8 g) by the percent, thus;

$$\begin{array}{r} 40.0 \\ .20\overline{)8.00} \\ 8\,0 \\ \hline 00 \end{array}$$

40.0 g, the weight of 20% mixture that would contain 8 g of substance Y.

3. To find the percentage strength when the amount of the active ingredient and the total quantity of the mixture are known, divide the weight or volume of the active ingredient by the total weight or volume of the mixture. Multiply the resulting answer by 100 to convert the decimal fraction to percent.

Example: Find the percentage strength of Z if 300 g of a mixture contains 90 g of substance Z.

Solution:

$$\begin{array}{r} 0.3 \\ 300\overline{)90.00} \\ 90\phantom{.00} \\ \hline 00 \end{array}$$

0.3 g, is the percent of Z expressed as a decimal fraction.

$0.3 \times 100\ (\%) = 30\%$ of Z in the mixture.

**Alternate Method for Solving Percentage Problems**

The alternate method for solving percentage problems incorporates the three rules discussed above into one equation. This method is often preferred since it eliminates errors that may result from misinterpreting the facts given in the problem.

1. Percent strength = $\dfrac{\text{Amount of active ingredient}}{\text{Total amount of preparation}} \times 100(\%)$

Examples:

a. Calculate the percent of A in a solution if 120 g of solution contains 6 g of A.

Solution: Substitute the known facts in the equation and use X for percent (the unknown factor).

$$X = 6/120 \times 100(\%) = 5\ (\%)$$

Therefore X = 5, which is the percent strength of the solution.

b. Calculate the amount of active ingredient m 300 g of a 5070 mixture of active ingredient B.

Solution: Convert 5% to a decimal fraction 0.05. Substitute the known facts in the equations and use X for the amount of active ingredient (unknown).

$$0.05 = X/300 \qquad x = 15\ \text{g}$$

2. A variation of equation 1 uses "parts per hundred" instead of percent with X used as the unknown.

$$\frac{\text{Amount of active ingredient}}{\text{Amount of total preparation}} = \frac{\text{Parts of active ingredient}}{100\ \text{parts (total mixture)}}$$

Example: Ascertain the percent B in a mixture of 600g that contains 15 g of B.

Solution: $15/600 = X/100$
cross multiply
$X = (15 \times 100)/600$ or $X = 1500/600$
$X = 2.5$. The parts of active ingredient per hundred parts of total mixture or 2.5%.

## RATIO AND PROPORTION

RATIO is the relationship of one quantity to another quantity of like units. Ratios are indicated as 5:2, 4:1; these would be read as 5 to 2, 4 to 1.

A ratio can exist only between units of the same kind, as the ratio of percent to percent, grams to grams, dollars to dollars; in other words, the denominates must be constant.

PROPORTION is two equal ratios considered simultaneously.

Example: 1:3::3:9

Since the ratios are equal, the proportion may also be written: 1:3 = 3:9.

### Terms of Proportion

The first and fourth terms (the terms on the ends) are called the "extremes." The second and third terms (middle terms) are called the "means."

In a proportion the product of the means equals the product of the extremes; therefore, when three terms are known, the fourth or unknown term may be determined.

### Application of Proportion

The important factor when working proportions is to put the right values in the right places within the proportion. By following a few basic rules, you can accomplish this without difficulty and solve the problem correctly.

In numbering the four positions of a proportion from left to right, i.e., first, second, third, and fourth, observe the following rules:

1. Let X (the unknown value) always be in the fourth position.
2. Let the unit of like value to X be the third position.
3. If X will be smaller than the third position, place the smaller of the two leftover values in the second position; if X will be larger, place the larger of the two values in the second position.
4. Place the last value in the first position.

When the proportion is correctly placed, multiply the extremes and the means and determine the value of X, the unknown quantity.

Example: What is the percent strength of 500 ml of 70% alcohol to which 150 ml of water have been added? When adding 150 ml to 500 ml, the total quantity will be 650 ml; consequently, our four values will be 500 ml, 650 ml, 70% and X, the unknown percent. When you use the above rules, the problem will appear as follow: X will be in the fourth position. Since X will solve as percent, the unit for like value for the third position will be the 70 of the original solution. When we add water to a solution, the strength is diluted; consequently, the 70 percent strength of this solution will be lessened when we add the extra 150 ml of water. Therefore, the smaller of the two figures (650 and 500) will be placed in the second position: 500.650 remains for the first position. The proportion appears as follows:

$650 : 500 :: 70 : X$

Multiplying the extremes and the means, we arrive at:

$650\ X = 35{,}000$

Consequently, by dividing 650 into 35,000, we would arrive at:

$X = 53.8$

When 150 ml of water are added to 500 ml of 70% alcohol, we would then have 650 ml of 53.8% solution.

Example: 1000 ml of 25% solution is evaporated to 400 ml.

What is the percent strength?

Letting X be the fourth position, and the unit of like value (15%) the third, we realize that by evaporating the solution it becomes stronger; therefore, the LARGER of the other two values (1000) will occupy the second place and 400 will be the first position, thus:

$400 : 1000 :: 25 : X$

Multiplying the extremes and the means, we arrive at:

$$400\ X = 25{,}000$$

By dividing 400 into 25,000, we get:

$$X = 62.5\%$$

**Solution Processes**

A great majority of drugs today are dispensed in solution, primarily because they are easier to take in that state, and also because their strength can be more readily cent rolled.

Although solutions may be either liquid, gaseous, or solid, we will concern ourselves here only with liquid solution, since they are of primary importance in pharmacy.

A solution is a homogeneous mixture of two or more substances, all having completely lost their physical identity. The liquid into which the ingredients are dissolved is called the solvent, and the substances that have been dissolved in it are called the solutes.

NOTE: A solution can consist of many solutes and more than one solvent.

**SOLUBILITY.—** The ability of a solid to dissolve in a given amount of solvent is called its volubility.

Conditions that influence volubility are as follows:

1. The degree of subdivision of the solute
2. Agitation or stirring
3. Temperature— If a solution contains all of the certain solute that the solvent will hold in solution, the solution is said to be saturated. By raising the temperature of the solution, the solvent will dissolve more of the solute than could have been dissolved under normal condition. It is then said to be supersaturated.

A good place to find a drug's volubility and solution media is the USP-NF. A very good example of how this is stated is ammonium chloride, USP-NF, which reads:

"One g dissolves in about 3 ml of water, in about 100 ml of alcohol, and in about 8 ml of glycerine. One g dissolves in about 1.4 ml of boiling water."

By the above it can readily be seen that ammonium chloride is very soluble in water, only slightly soluble in alcohol, and fairly soluble in glycerine.

Classes of Solutions:

1. True solution—a solution in which the particles of the solute are so small that they pass through both filter paper and animal membrane. Example: salt in water

2. Colloidal solution—a solution in which the particles of the solute will pass through filter paper and not through animal membrane.

In the preparation of solutions in pharmacy, there are three distinct types:

WEIGHT IN WEIGHT (W/W)—This is an expression of concentration in terms of number of g of active ingredient per 100 g total solution.

Example: 2 g of potassium iodide in 100 g of solution (total weight) is a 2% (W/W) solution of potassium iodide.

WEIGHT IN VOLUME (W/V)—This is an expression of concentration in terms of number of g of active ingredient per 100 ml of solution.

Example: 85 g of sucrose in 100 ml of total solution would result in an 85070 (W/V) solution of sucrose.

VOLUME IN VOLUME (V/V)—This is an expression of concentration in terms of number of milliliters of active ingredient per 100 ml of solution.

Example: 5 ml of clove oil in 100 ml of total solution would result in a 5% (V/V) solution of clove oil.

**Ratio Solutions**

Ratio solutions are usually prepared in strengths as follows: 1:10, 1:150, 1:1000, 1:25000. etc, using even numbers to simplify the calculations. When a solution is made by this method, the first term of the ratio expresses the part of the solute, while the second term expresses the total amount of the finished product.

Rules for solving ratio solution problems are as follows:

W/W solution: Divide the total weight (grams) of solution desired by the larger number of the ratio, and the quotient will be the number of grams of the solute to be used.

Example: How many grams of $KMNO_4$ are needed to make 500 g of a 1:2000 solution?

**500 ÷ 2000 = 0.25** g of drug needed.

**500 - 0.25 = 499.75** g of solvent needed.

W/V solution: Divide the total volume in ml of solution desired by the larger number of the ratio, and the quotient will be the number of grams of the solute needed.

Example: How many grams of bichloride of mercury are needed to prepare 500 ml of a 1:1000 solution?

**500 ÷ 1000 = 0.5** g of drug needed.

Take 0.5 g of the drug and add sufficient (q.s. with) solvent to make 500 ml; this gives you 1:1000 strength.

V/V Solution: Divide the total volume in ml of the solution desired by the larger number of the ratio, and the quotient will be the number of ml of the drug to be used.

Example: How many milliliters of HCl would be used to prepare a 1:250 solution with the total volume to be 500 ml?

**500 ÷ 250 = 2** ml of HCl needed

Percentage solutions from stock and/or ratio solutions:

Example: From a 1:10 solution of silver nitrate in water, prepare 60 ml of a 1.5% solution of the same ingredients.

A 1:10 (W/V) solution contains 1 g of solute and enough solvent (q.s.) to total a 10 ml solution (finished product). Therefore, 1 ml of the solution would contain 0.1 g of the solute. Since it is required that 0.9 g of the solute be used to prepare 60 ml of the required strength, use 9 ml of the stock solution and enough solvent (water) to make the total volume measure 60 ml.

## SPECIFIC GRAVITY

Specific gravity is the ratio of the weight of a given substance to the weight of an equal volume of a substance chosen as a standard. It is a means of determining the strength, purity, or volume of a substance. Water is the chosen substance as the standard for solids and liquids.

It is known that water has a unit weight of 1 g per ml of space occupied. Basic formulas predicated on this information are as follows:

$$\text{ml} \times \text{S/G} = \text{weight}$$

$$\frac{\text{weight}}{\text{S/G}} = \text{ml}$$

$$\frac{\text{weight}}{\text{ml}} = \text{S/G}$$

Sample problems:

1. What is the weight in grams of 300 ml of alcohol with a specific gravity of 0.8?

   **ml × S/G = wt     300 × 0.8 = 240 g**

2. 900 g of glycerine with a S/G of 1.25 would measure how many milliliters?

   $$\frac{\text{g}}{\text{S/G}} = \text{ml} \quad \frac{900}{1.25} = \text{ml}$$

   $$\begin{array}{r} 720.\ \text{ml} \\ 125\overline{)90000} \\ \underline{875} \\ 250 \\ \underline{250} \\ 0 \\ \underline{0} \end{array}$$

3. If 50 ml of a liquid has a weight of 50.5 g, what is the specific gravity?

   **wt/ml = S/G     50.5/50 = 1.01     S/G = 1.01**

## COMPOUNDING

By definition, compounding implies the various processes and procedures required to manufacture a pharmaceutical preparation for dispensing to the patient. The art of compounding is a profession in itself, and a great deal more training and knowledge is required than can be given here.

It is the intent of this section to familiarize you with the basics of compounding, in order that you may understand and fully appreciate the complexities involved in bringing the correct medication, properly prepared, to the patient.

## ETHICS OF COMPOUNDING

Since the patient is of prime importance when compounding medicines, the corpsman must be a person of integrity, skill, and knowledge. Accuracy, both in kind and amount is of utmost importance, as is cleanliness and orderliness, to ensure the proper manufacture of medicinal substances.

Pharmaceutical compounding is not an area for shortcuts or substitution, nor is there room for dishonest or haphazard attitudes.

## PHARMACEUTICAL PROCESSES

In order to understand the principles of compounding, we must first be familiar with some of the physical processes involved.

### Comminution

Comminution is the process of physical reduction of a substance to fine particle size, which makes the substance or drug easier to dissolve and compound.

The processes for comminution are cutting, grating, grinding, pulverizing, trituration, and levitation. The first four terms are self-explanatory and are employed primarily on animal and vegetable drugs from which we wish to extract active principles.

TRITURATION—This is a process of reducing a solid to a very fine powder by grinding in a mortar and pestle, which will be described in detail later in this chapter.

LEVITATION—Solids can be ground to even finer subdivision by adding a small amount of liquid to make a paste and triturating further. This process is ideal for ointments, creams, and lotions.

### Processes of Separation

A important phase of compounding medicines is that of separating solids from liquids by various means. The main purpose is to purify the liquid, but the process is also employed to obtain certain desirable solids from liquids.

DECANTATION—Probably the simplest method of separating solids from liquids is the process of recantation, which merely means letting the solids settle to the bottom of the container and pouring off the liquid by gently tilting the container.

COLATION—When the solids in a liquid are fairly large, a simple method of separation is passing the mixture through a strainer, cheesecloth, or muslin, allowing the fluid to pass through and retaining the solids.

FILTRATION—This is the process of separating a solid from a liquid with the purpose of obtaining the liquid in a clear transparent state, devoid of impurities. The liquid, called the filtrate, is passed through a porous barrier called the filter. The filtering medium may be paper, paper pulp, asbestos, cotton, felt, sand, or other suitable material.

In pharmacy, we have commercial filter paper readily available for this purpose, and in large installation, mechanical filtering machines filter large quantities in a fraction of the time otherwise required.

CENTRIFUGATION—Solids are separated from liquids by the centrifugal force or rotation.

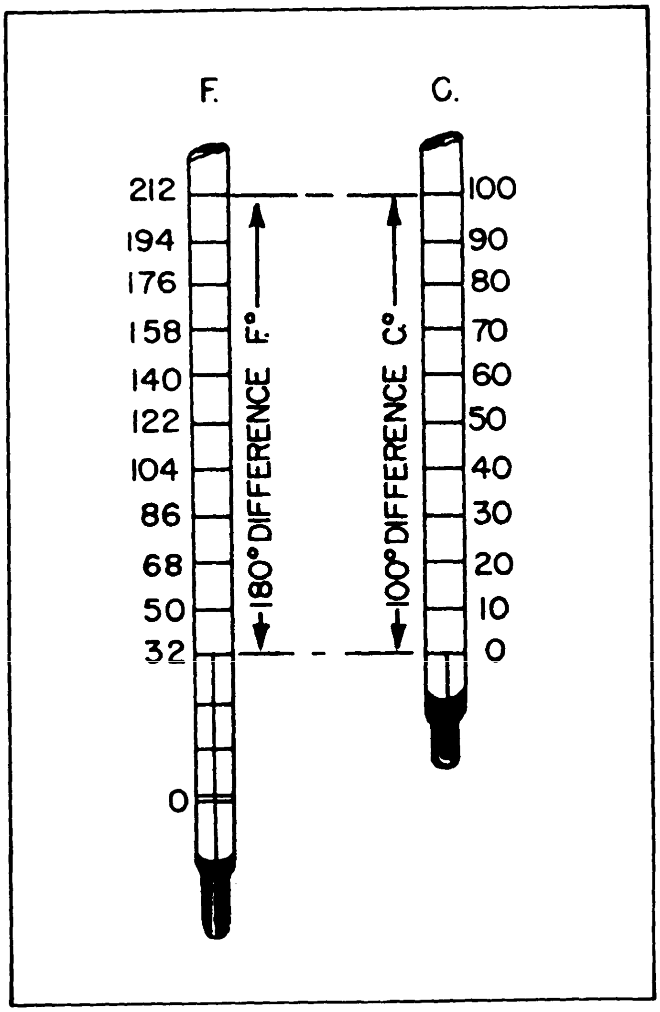
PRECIPITATION—In this method, solids are formed from previously clear solutions by either physical or chemical means and then separated by filtration or other previously mentioned means.

## HEAT

Heat is a very important tool in compounding and must be thoroughly understood.

Heat is a form of energy and is measured in degrees. Two common scales of temperature are in use today, Fahrenheit, based on the freezing point of water as 32° and the boiling point as 212°; and Celsius (centigrade) with the freezing point of water as 0° and the boiling point as 100°. The Celsius scale is now used in almost all temperature determinations, such as scientific work, the weather, etc. Unless otherwise specified, all temperatures given in the USP-NF and *Remington's Pharmaceutical Sciences* are Celsius.

Thermometers are instruments for measuring the intensities of heat. Most of these instruments are based on the expansion of liquids and vary only in the purpose for which they were intended.




33.11

**Figure 8-2.—Temperature comparison.**

The boiling point of water is 100°C and 212°F. The difference between the boiling point and the freezing point of water is 100° and 180°F. See figure 8-2. Therefore, within this span on the thermometers, 1°C equals 1.8°F.

However, temperature readings on either scale are taken in respect to the number of degrees below or above zero, thus 320 must be added to the 180°F in order to obtain the total reading from the Fahrenheit zero point. Substituting these values into the conversion formula (°C x 1.8) + 32, we have (100° x 1.8) + 32° = 212°F.

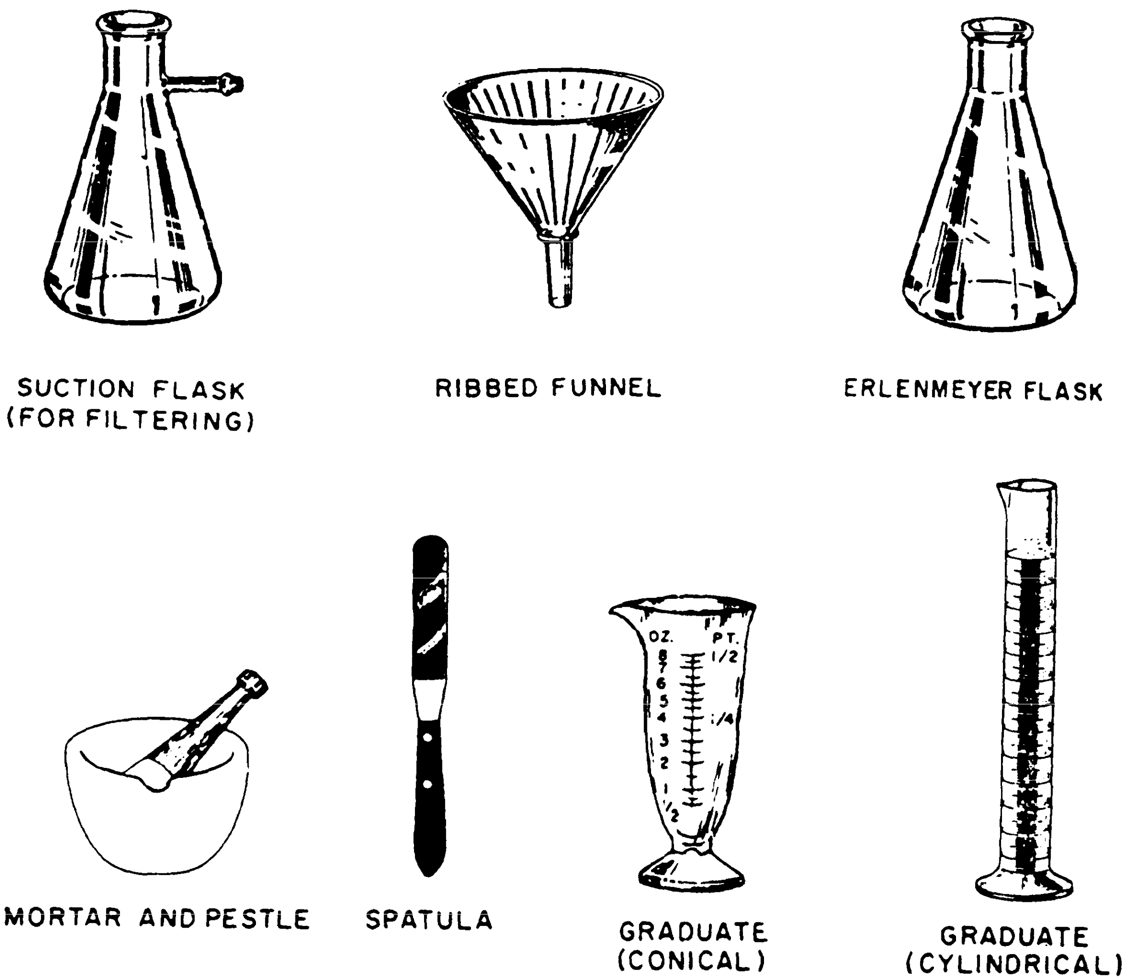
If we wish to convert Fahrenheit degrees to centigrade degrees, the algebraic order of calculation must be reversed and we find that (°F – 32°, ÷ 1.8 = 1.8 = °C. Substituting the values we find (212° – 32°) ÷ 1.8 = 100°C.

To summarize, conversion formulas are as follows:

$$°F = (°C \times 1.8) + 32°$$
$$°C = (°F - 32°) \div 1.8$$

EBULLITION—This is probably the most common process involving heat. The term merely means boiling, to wit, raising the temperature of a liquid to the point where it changes to vapor or steam. All liquids have a definite temperature at which this occurs, a factor called the boiling point and the basis for separation from other liquids by distillation.

Boiling is used extensively in compounding, since in most cases the volubility of the preparation is increased. As an example, consider making instant coffee with cold water compared to using hot water.




154.52

**Figure 8-3.—Pharmacy equipment.**

FUSION—This process is commonly called "melting"—changing a solid to a semisolid or liquid by applying heat. All substances have a definite temperature at which this change occurs, which is known as the "melting point."

Pharmaceutically, fusion is used extensively in making ointments, creams, lotions, and suppositories, since the solid in its liquid state is easier to mix with other ingredients.

Other common processes involving the application of heat are:

DISTILLATION—Converting a liquid to a vapor by applying heat and condensing the vapor back to a liquid by cooling. The purpose here is purification and separation of liquids.

## PHARMACEUTICAL INSTRUMENTS

Now you are ready to become familiar with the tools or instruments of pharmacy. See figure 8-3.

### Ointment Tile

This is a flat rectangular or square slab of glass or porcelain. It is also an excellent work surface for triturating and levitating small amounts of ointments and suppository masses. The ointment tile should never be scratched and should be cleaned and stored when not in use.

### Spatula

A knifelike utensil with a rounded, flexible, smoothly ground blade, available in various sizes.

The spatula is used to "work" powders, ointments, and creams in the process of levitation and trituration. It is also used to transfer quantities of drugs from their containers to the prescription balance. Spatulas are not to be used to pry open cans, as screwdrivers, or as knives for opening boxes. Once the surface is scratched or the edges bent, the spatula's precision surface is ruined and it becomes useless.

### Mortar and Pestle

These two items always go together, one being useless without the other. The mortar is basically a heavy bowl, with one distinct property: the inside concavity is geometrically hemispheric. The accompanying pestle is primarily a handtool, whose tip is of identical material as the mortar, and its convexity forms a perfect hemisphere. The reason for the two opposing hemispheres is to provide an even grinding surface when in use. Mortars and pestles are made of glass, metal, or unglazed pottery called wedgewood. Glass is always used when triturating very pure products, such as eye ointments, and when the preparations contain stains. Metal ones should never by used when the drugs are likely to react with the metals.

### Graduates

These are conical or cylindrical clear glass containers, graduated to specified quantities, used to measure liquids volumetrically. Measuring should always be done at eye level.

### Wire Gauze

A wire gauze is placed under a container in order that the heating flame will distribute uniformly about the bottom of the container. The wire is a good conductor of heat, and the heat penetrates rapidly.

### Pipettes

Pipettes are narrow, graduated tubes for measuring small quantities of liquids volumetrically.

### Suction Flask

The suction flask is an Erlenmeyer flask with a tube extending from the neck at a right angle. The tube provides a connection site for attaching a means of suction. When a filtering apparatus is attached to the neck of the flask and suction applied, the filtering process is speeded up by the vacuum created in the flask by the suction.

### Ribbed Funnel

The ribbed funnel is a utensil used in filtering and is most commonly made of glass, but other substances (tin, copper, rubber) are occasionally used. The funnel is shaped so that the inside surface tapers at a 600 angle, ending in a tapered delivery spout. The inside surface is "ribbed" to allow air to escape from between the glass and the filtering medium, thus improving the filtration process.

### Pharmaceutical Baths

Baths are vessels in which any substance in a container can be heated uniformly by immersion into the conductive matter of the bath. Baths are commonly used when a substance cannot be heated above a certain temperature. For example, cocoa butter cannot be heated above 100°F during the manufacture of suppositories.

The most common type of bath is a circular bowl made of tinned copper. The bowl contains water and as this water is heated, the heat is transmitted to the container that is placed in the bath. Using this method, you can maintain a constant temperature of 100°C over long periods.

## PHARMACEUTICAL BALANCES

There are two types of pharmaceutical balances in common use in the Navy: The single beam, equal arm balance, and the torsion balance. These balances are classified as either "Class A" or "Class B." The Class A balance is used for weighing loads from 120 mg to 120 g. All dispensing pharmacies are required to have at least one Class A balance on hand at all times. The Class B balance is optional equipment in the pharmacy, which is used to weigh loads of more than 648 mg, and must be conspicuously marked "Class B."

### Operation of the Torsion Balance

1. Place precut protective paper over each of the pans.
2. Adjust the balance so that the indicator reads zero.
3. Always place the weight on the right pan and the substance to be weighed on the left pan (facing the balance).

4. When the rider on the scale is used, return it to zero after each weighing.
5. Recheck the "balance" of the instrument after each substance is weighed.
6. Clean and properly secure the balance when weighing is completed.

**Care of the Balance**

1. Never add or remove items from the balance unless the balance is locked. It is the small knob at the bottom front of the balance. When this knob is turned all the way to the right, the balance beams will not move and are referred to as "locked." When this knob is turned all the way to the left, the balance beams will move to give the operator a reading. This position is referred to as the "unlocked" position.
2. Keep in a closed case in a dry, protected place.
3. Never leave the balance unlocked when not in use.
4. Handle weights with forceps to avoid collection of foreign matter that can cause inaccuracy.
5. Clean only with a dry rag. Never use any liquid on the balance.
6. Always protect the pan with paper. Waxed paper is best.
7. If the balance is to be moved for any distance, consult *Remington's Pharmaceutical Sciences* for instructions on how to secure the balance to prevent damage.

## PHARMACEUTICAL PREPARATIONS

### SYRUPS

Syrups are concentrated aqueous solutions of sucrose, containing flavoring or medicinal substances.

**Methods of Preparation**

In preparing syrups, the sucrose may be dissolved with the aid of heat, by agitation, or by percolation. The process to be used depends upon the ingredients of the syrup and the time available for completing its manufacture.

USES: Many of the syrups are used as vehicles. Their sweet taste causes them to be a preferred form for the administration of drugs.

EXAMPLES: Simple Syrup; Syrup of Orange

### ELIXIRS

Elixirs are aromatic, sweetened hydroalcoholic solutions containing medicinal substances. They are liquids having an aromatic odor and a pleasant taste. The color of elixirs varies according to the nature of the ingredients; some are artificially colored.

**Methods of Preparations**

Simple solution is the general process employed in preparing elixirs. Many are prepared, however, by adding the medicinal substances directly to aromatic elixir, which is an elixir-base. While elixirs are very simple to mix, it should be noted that most elixirs are very difficult to filter, and since most elixirs require filtration, suction filtration is the recommended method.

USES: Used internally. Their uses vary according to their ingredients.

EXAMPLE: Elixir of Terpin Hydrate

### LOTIONS

Lotions are liquid preparations, usually aqueous, containing the insoluble substances intended for external application. The insoluble ingredients must be in very fine particles to prevent irritation to the skin. They are dispensed with "Shake Well" labels and "External Use Only" labels.

USES: The use of each lotion is determined by its respective ingredients.

EXAMPLE: Calamine lotion

### SUSPENSIONS

Suspensions are coarse dispersions comprised of finely divided insoluble material suspended in a liquid medium. In order to keep the insoluble material in suspension, a third agent, called a suspending agent, is required.

**Method of Preparation**

There are no general methods for the preparation of suspensions; however, in order for the insoluble ingredients to remain in suspension, they must be in a fine degree of subdivision. Label suspensions with a "Shake Well" label.

USES: Suspensions are used for the administration of oral medicaments, which have low volubility in water or aqueous vehicles. Also, suspensions are used for parenteral drugs and ophthalmic solutions.

## OINTMENTS

Ointments are semisolid, fatty, or oily preparations of medicinal substances of such consistency as to be easily applied to the skin and gradually liquefy or melt at body temperature. Ointments vary in color according to their ingredients. The base of an ointment is generally of a greasy character, and the medicinal substances combined with it are always intended to be in very fine particles, uniformly distributed.

### Methods of Preparation

Incorporation: The medicinal substances are finely powdered, if necessary, and then they are levigated into the fatty base, either in the mortar or on the ointment tile.

Fusion: The fatty base is melted, then the finely powdered ingredients are added and mixed thoroughly. The solution is cooled so that the base, now containing the medicinal substances, returns to its natural state.

USES: Ointments have long been a preferred form for the external application of medicinal substances. In addition to the action of the medicinal substances combined with them, the fatty bases are emollient and protective in nature.

Example: Zinc Oxide Ointment

## SUPPOSITORIES

They are solid bodies intended to introduce medicinal substances into the various orifices of the body. The ingredients are incorporated in a base that melts at body temperature. They are of the following types:

- Rectal
- Vaginal
- Urethral

### Methods of Preparation

Fusion method: The ingredients are added to melted theobroma oil (cocoa butter), and the mixture poured into the suppository mold. The mixture is allowed to cool, and the suppositories are removed from the mold.

Hand Method: The medicinal ingredient is combined with theobroma oil, and the mixture is triturated into a pliable mass. The mass is rolled by hand into the shape of a cylinder and divided into the required number of equal parts, which are then formed into the desired shape.

USES: Suppositories are commonly used for the local application of medicinal substances, as in the treatment of hemorrhoids. Occasionally suppositories are used in administering medicinal substances when administration by mouth is not practical.

## CAPSULES

Capsules are gelatin shells containing solid or liquid medicinal substances to be taken orally. The most common type of capsule is that in which the medicine, in the form of a dry powder, is enclosed in transparent cases made of gelatin. They are in sized universally designated by numbers: 5, 4, 3, 2, 1, 0, 00, 000. The number 5 has the capacity of about 65 mg of aspirin powder and the 00 about 975 mg of the same substance. It should be noted that only sizes 3 through 00 are available through the Federal Stock System.

# INCOMPATIBILITIES

An understanding of incompatibilities can save the pharmacy technician valuable time in compounding as well as ensure the therapeutic efficiency of the products. Incompatibilities are divided into three classes: therapeutic, physical, and chemical.

## THERAPEUTIC

This type of incompatibility occurs when agents antagonistic to one another are prescribed together. Such circumstances seldom occur, but when they do it does not necessarily indicate a moment of forgetfulness on the part of the physician. Such agents may have been used together in order for one agent to modify the activity of the other. When circumstances produce a feeling of doubt on the part of the pharmacy technician, the prescribing physician should be consulted.

## PHYSICAL

Physical incompatibilities are often called pharmaceutical incompatibilities and are evidenced by the failure of the drugs to combine properly. It is virtually impossible for uniform dosages of medicine to be given from such solutions or mixtures. Ingredients such as oil and water, which are physically repellant to each other, and substances that are insoluble in the prescribed vehicle are primary examples of physical incompatibilities.

## CHEMICAL

This type of incompatibility exists when agents are prescribed that react chemically when mixed, altering the composition of one or more of the constituents.

## MANIFESTATIONS OF INCOMPATIBILITY

- Insolubility of prescribed agent in vehicle (physical)
- Immiscibility of two or more liquids (physical)
- Precipitation due to change in menstrum that results in decreased volubility is called salting out (physical)
- Eutexia—the liquefaction of solids mixed in dry state (physical)
- Cementation of insoluble ingredients in liquid mixtures (physical)
- Evolution in color (chemical)
- Oxidation-reduction or explosive reaction (chemical)
- Precipitation due to chemical reaction (chemical)
- Inactivation of sulfa drugs by procaine HCl (therapeutic)

### Corrective Measures

- Addition of an ingredient that does not alter the therapeutic value, such as the addition of an ingredient to alter volubility of an agent
- Omission of an agent that has no therapeutic value, or that maybe dispensed separately
- Change of an ingredient. Minor changes such as a soluble form of an ingredient for an insoluble form are included.
- Change of a solvent
- The utilization of special techniques in compounding

# PRACTICAL PHARMACY PROCEDURES

## COMPOUNDING

- Read the prescription, formula, or recipe carefully. Be sure you understand its contents.
- Make sure that all ingredients required are on hand, in the quantities required.
- Any substitutions or changes must be approved by the prescriber and initialed.
- As you weigh or measure each ingredient, check it off the prescription. If any doubt exists as to what or how much has been used, discard and begin again. [t is better to waste some material than to chance a faulty medication.
- Be neat, precise, and methodical when compounding drugs. Haste not only makes waste here—it also endangers the patient.
- Adhere to the sequences of compounding the ingredients and the techniques prescribed by the formula or recipe—there is a reason, otherwise they would not be specified.
- Strive for "pharmaceutically elegant" results, such as smooth ointments and creams, devoid of lumps and grit; clear solution; etc.

- Store and preserve your products in neat, clean containers, clearly labeled, readily accessible and light-resistant.

**DISPENSING**

- Remember that the contents of a prescription are a confidential matter between the physician, the patient, and the person who is filling it.

- All prescriptions must be dispensed neatly, in an appropriate container of suitable size.

- All prescriptions must be properly labeled and properly marked ("Shake Well," "External Use Only," etc.).

- Never dispense drugs of doubtful origin or potency. Never use ingredients of doubtful origin or potency when compounding a prescription.

- Never dispense drugs suspected of deterioration, either due to faulty storage or use.

- WHEN IN DOUBT, THROW IT OUT!

- Always double check the prescription for correctness, up to and including the patient, making sure that he or she is in fact the person for whom the drug is intended.

- Refer to the *Manual of the Medical Department,* chapter 21 for information to be recorded on each prescription form at the time of dispensing.

**REFERENCE**

Stoklosa, Mitchell J., and Ansel, Howard C., *Pharmaceutical Calculations,* 8th ed., Lea & Febiger, Philadelphia, 1986.